

PSL

Power Sensors Ltd

A Division of Power Standards Lab

PSL

PQube[®] 3

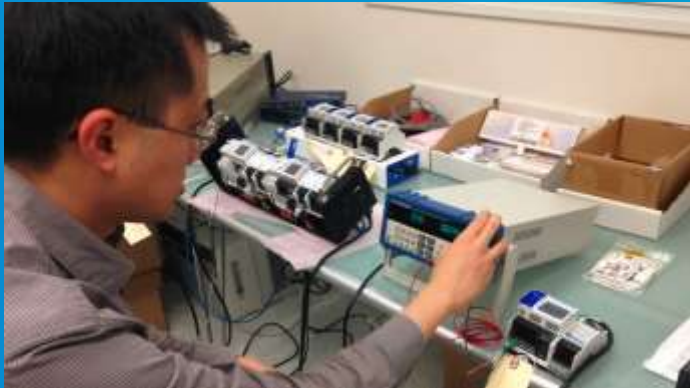
Power Analysis



PSL – Power Sensors Ltd

a Division of Power Standards

- > Founded in 2000 - Alameda CA , USA
- > Power Quality Experts - IEC standards
- > Manufacturer of leading Power Quality monitors



We Capture All Bad Power Quality





IEC-61000-4-30 Class A Edition 3

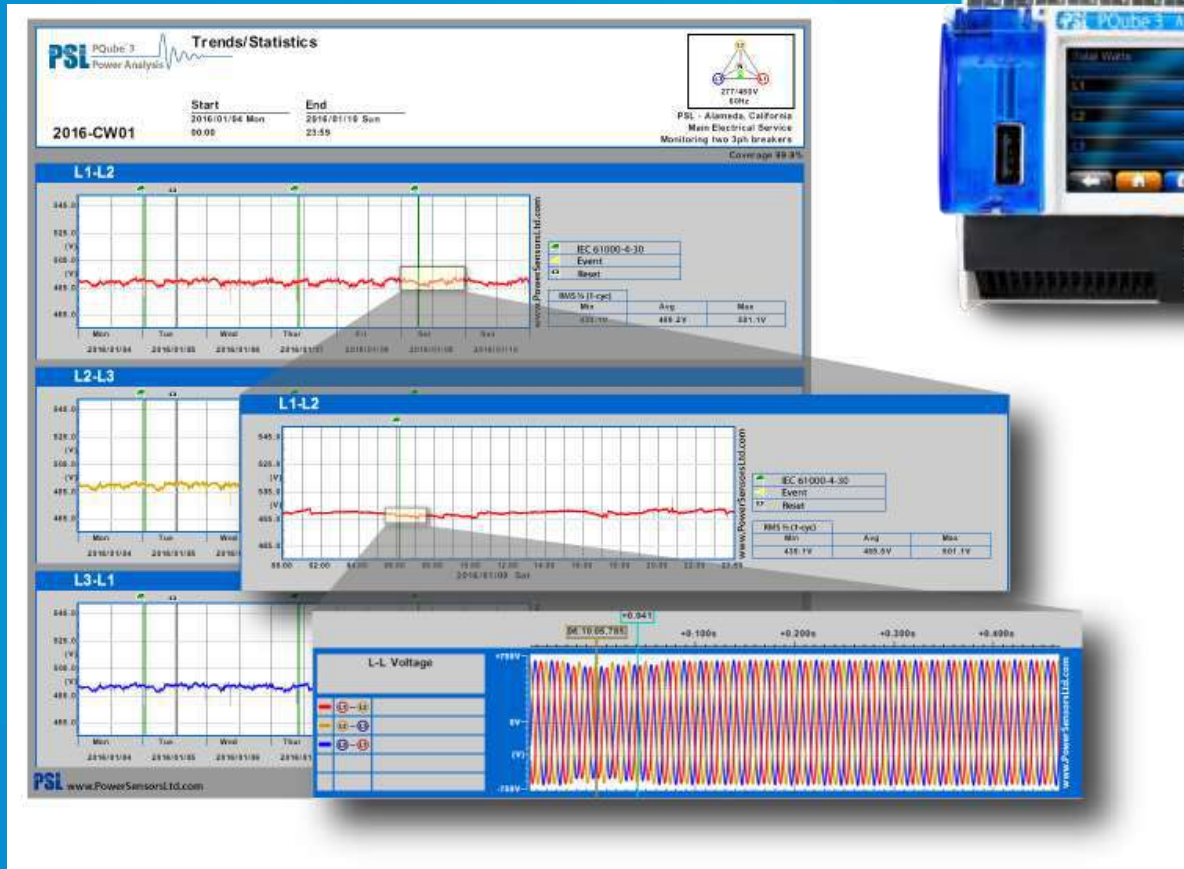
- Class A dips/swells/interruptions
- Class A mains frequency

- Class A voltage harmonics – up to 50th – gapless
- Class A flicker – Class F1 performance (IEC 61000-4-15)
- Class A Current harmonics – up to 50th – gapless
- Class A voltage and current unbalances (zero & negative seq)

- Class A Rapid Voltage changes
- 250 nano-seconds High Frequency Transient capture
- 2kHz-150kHz conducted emissions – Supra-harmonics

IEC62053-22 Class 0.2S
ANSI C12.20 Class 0.2
Revenue Grade Meter Accuracy
Including Current Transformers !

PQube 3: sends the information recorded directly to your email inbox !



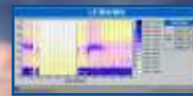
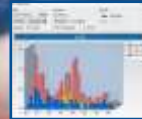
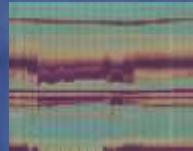
NO SOFTWARE

PQUBE 3e

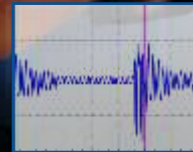
Bringing innovation, accuracy, and versatility to Power Analysis



High Frequency Transients
Residuals & Audio Frequency



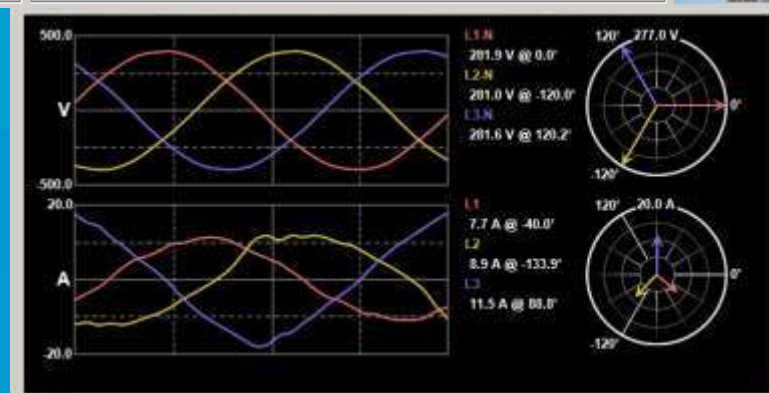
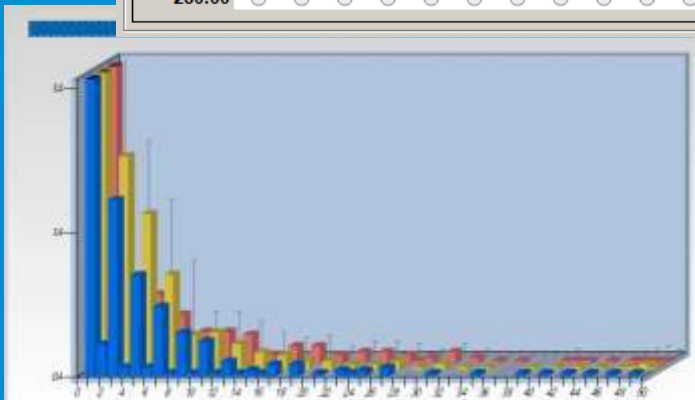
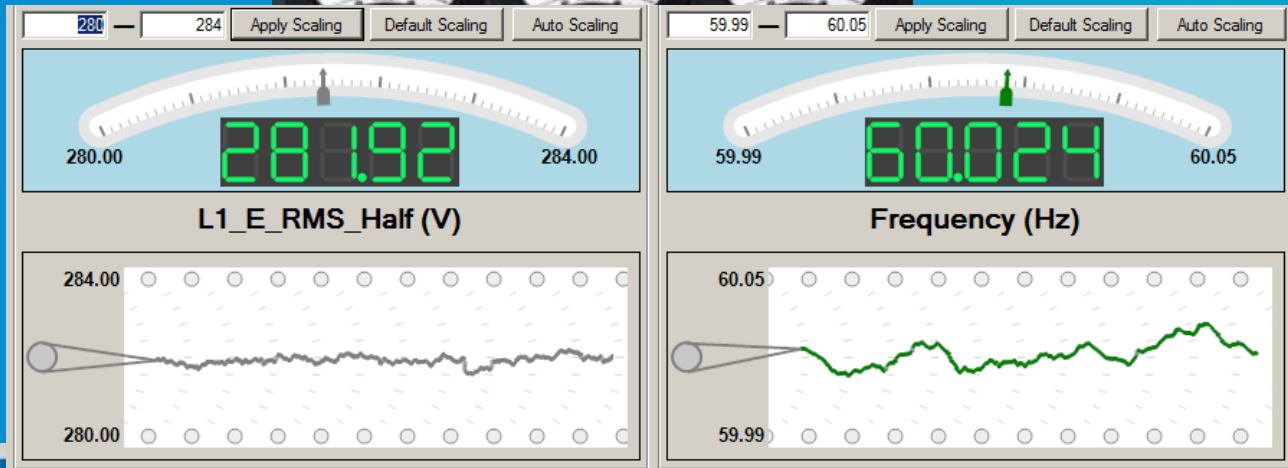
GIF, CSV and PQDIF formats FULLY supported

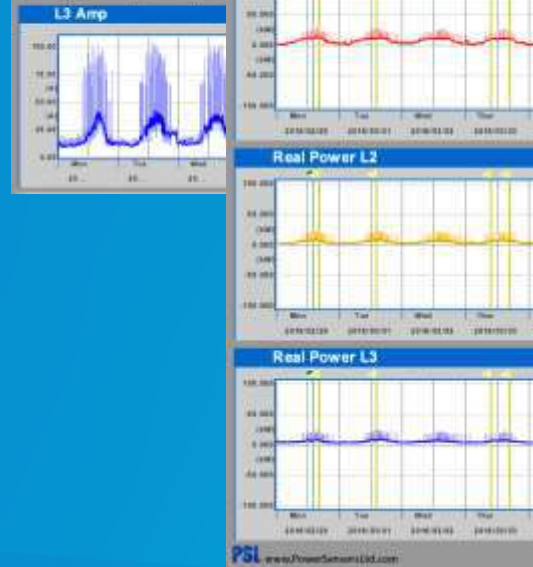
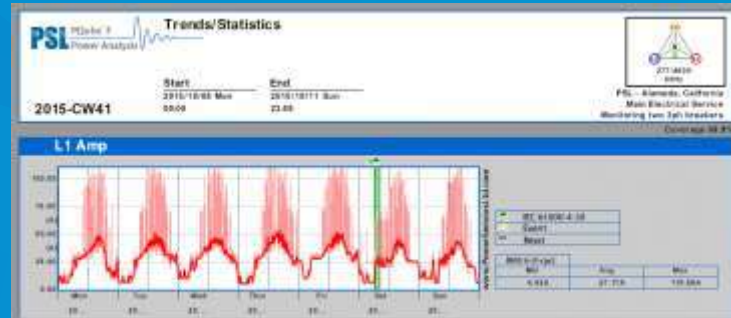




PQube 3

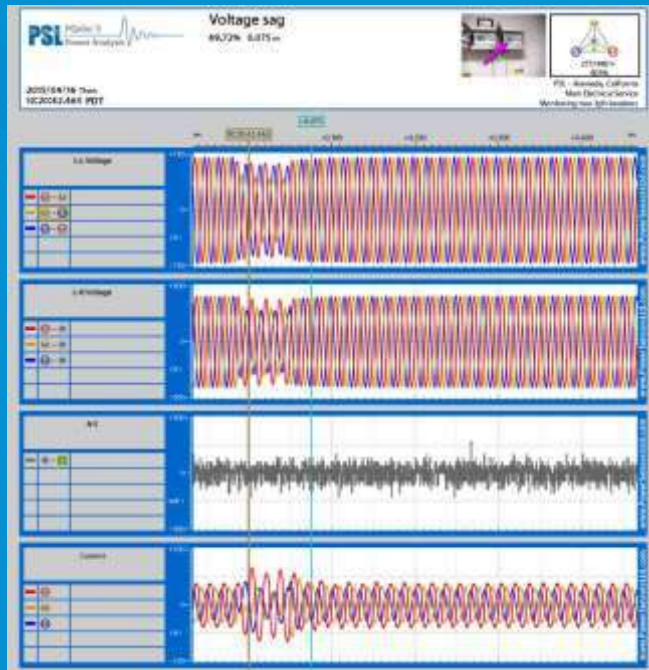
Best Energy Information Device
Used as a Real Time Meter





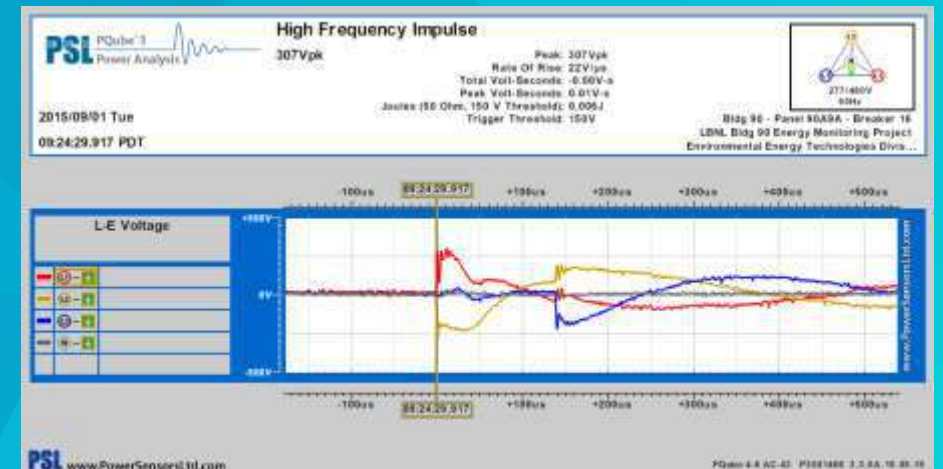
PQube 3

Best Energy Information Device
Strip Chart Recorder with
min/avg/max values
Never miss a single cycle!



PQube 3

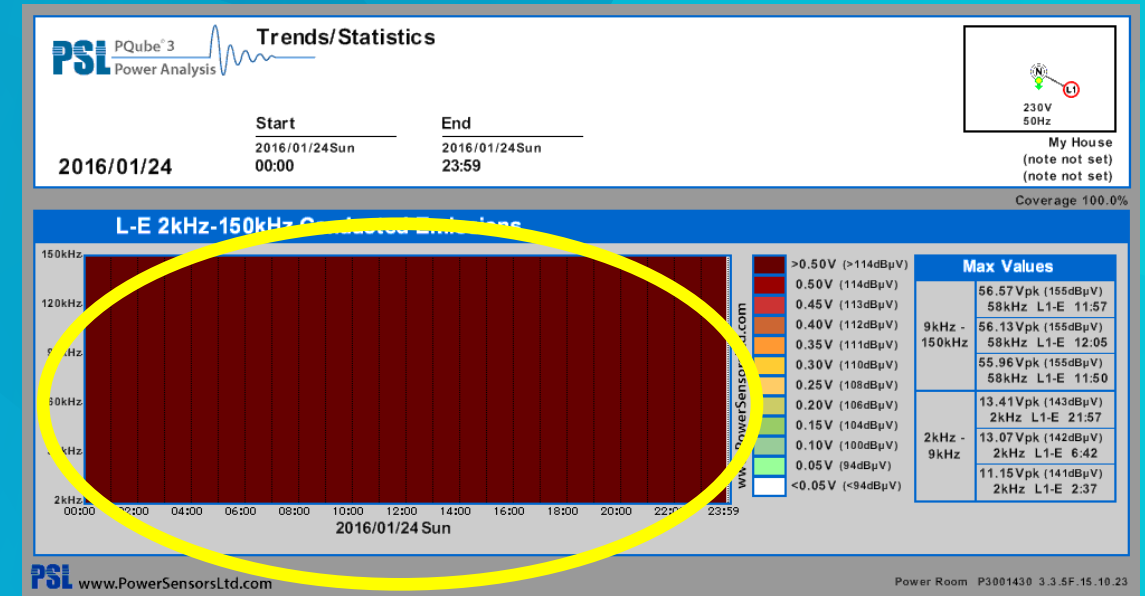
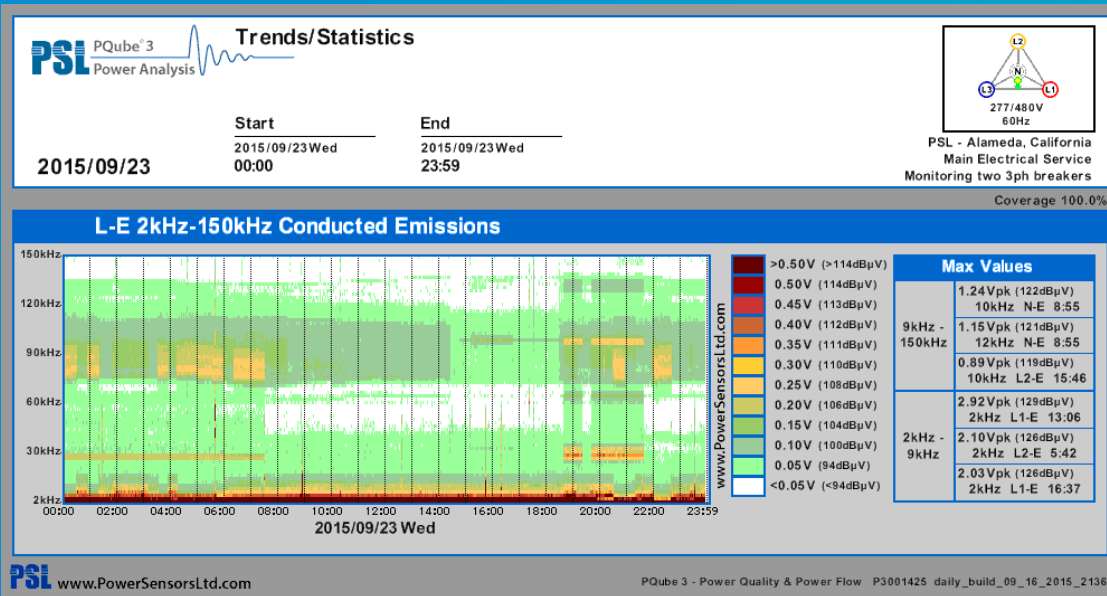
Best Energy Information Device
Oscilloscope Triggers
Never miss a single cycle!



Monitoring 2 kHz to 150 kHz Emissions Photovoltaic power generation (PV sites)

Residential/commercial area
No or low PV penetration

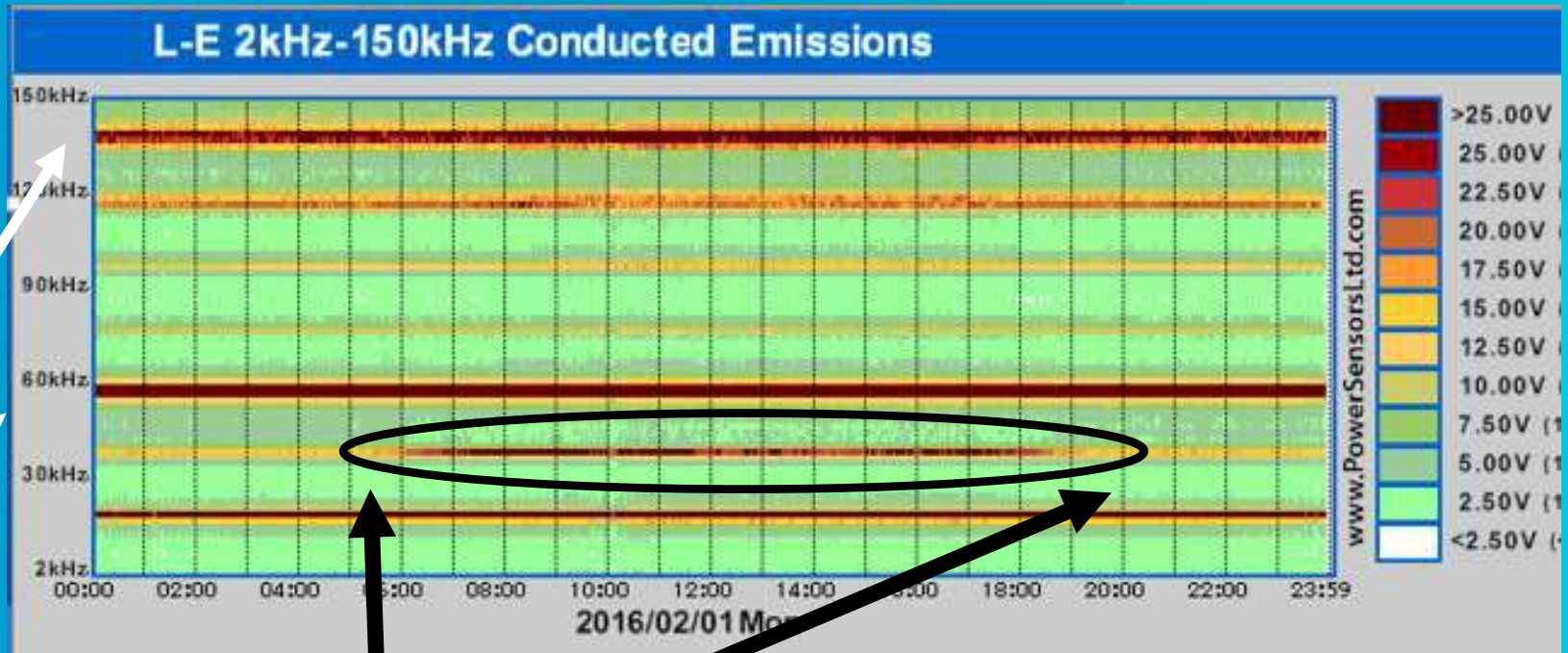
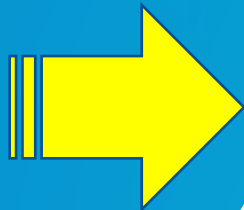
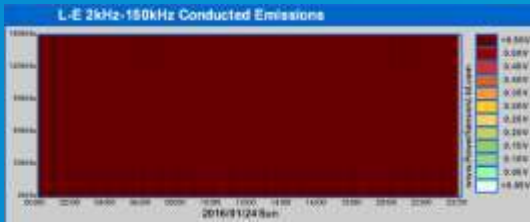
Residential area
close to a major PV inverter



2 kHz to 150 kHz Emissions Photovoltaic power generation (PV sites)

Color map : 0.0 – 25.0V

Color map : 0.0 – 0.5V



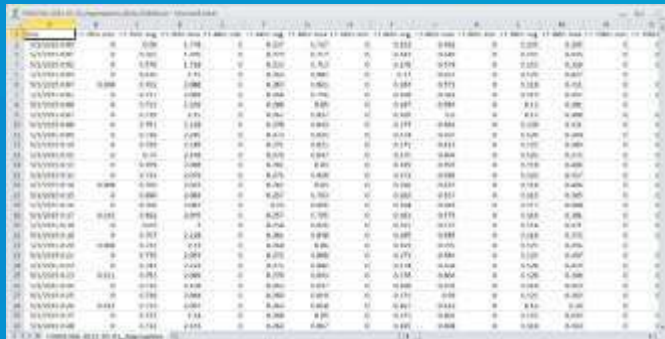
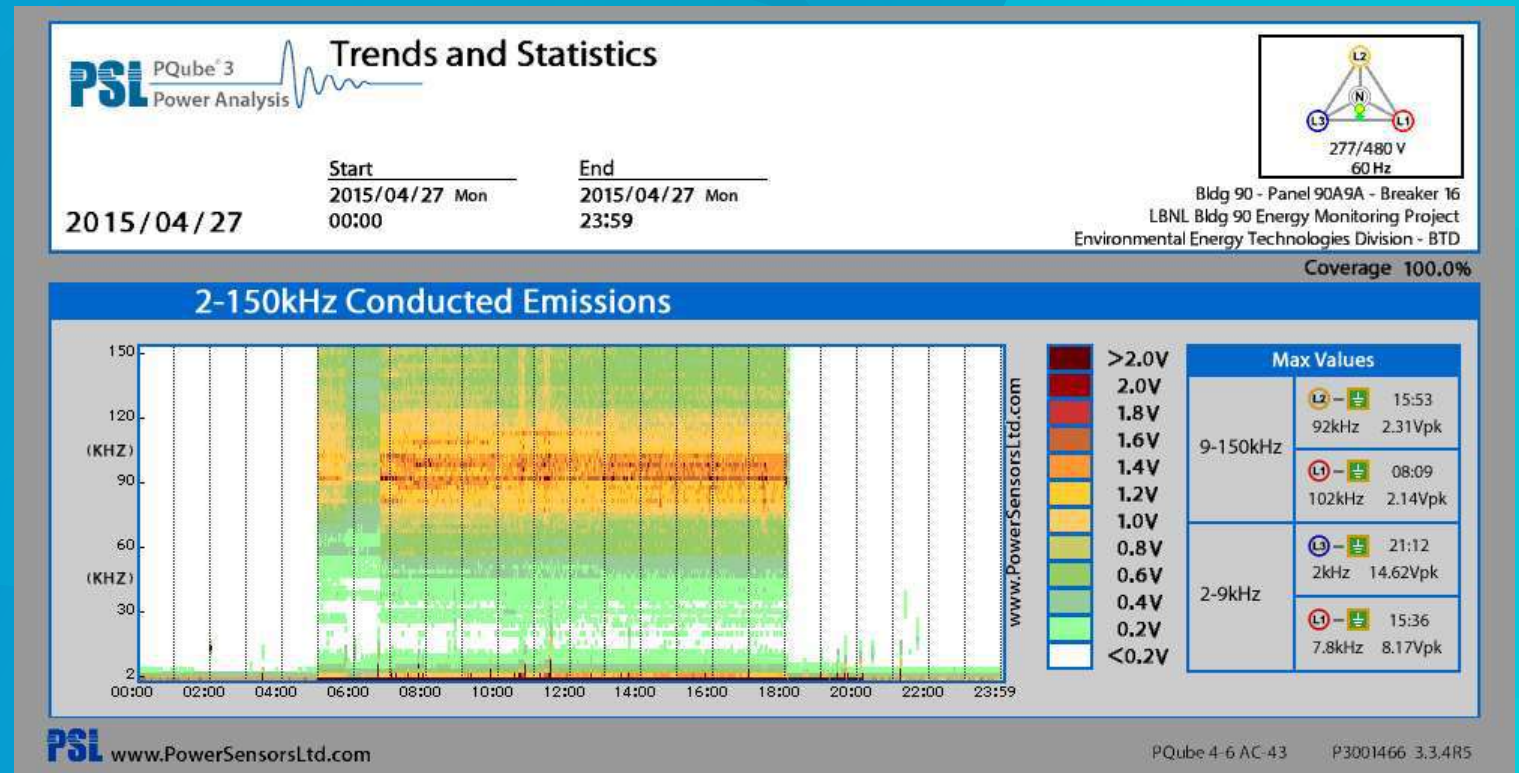
Continuous emissions
(another source)

Daylight
Photovoltaic power generation

2kHz to 150 kHz Emissions

No software: PQube3 generated this graph internally and automatically emails to your inbox

And also in ASCII format (CSV)

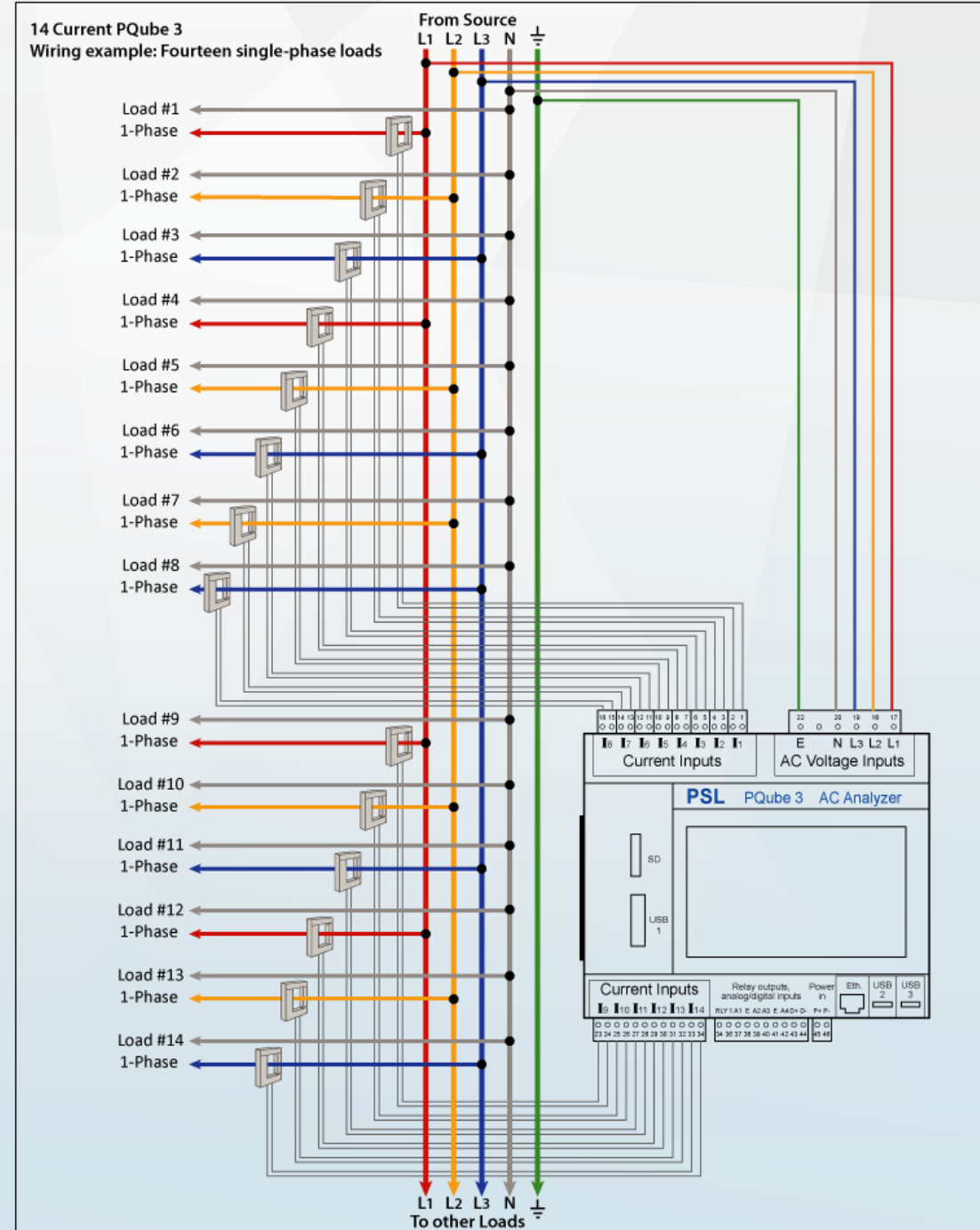



14 current channels
14 Single Phase Loads

Eight current channels

Monitoring scenarios :

- 3 phase currents, Neutral current, Ground current (5 channels) PLUS 3 independent single phase loads
- Or 3 Phase currents , and 5 independent single phase channels

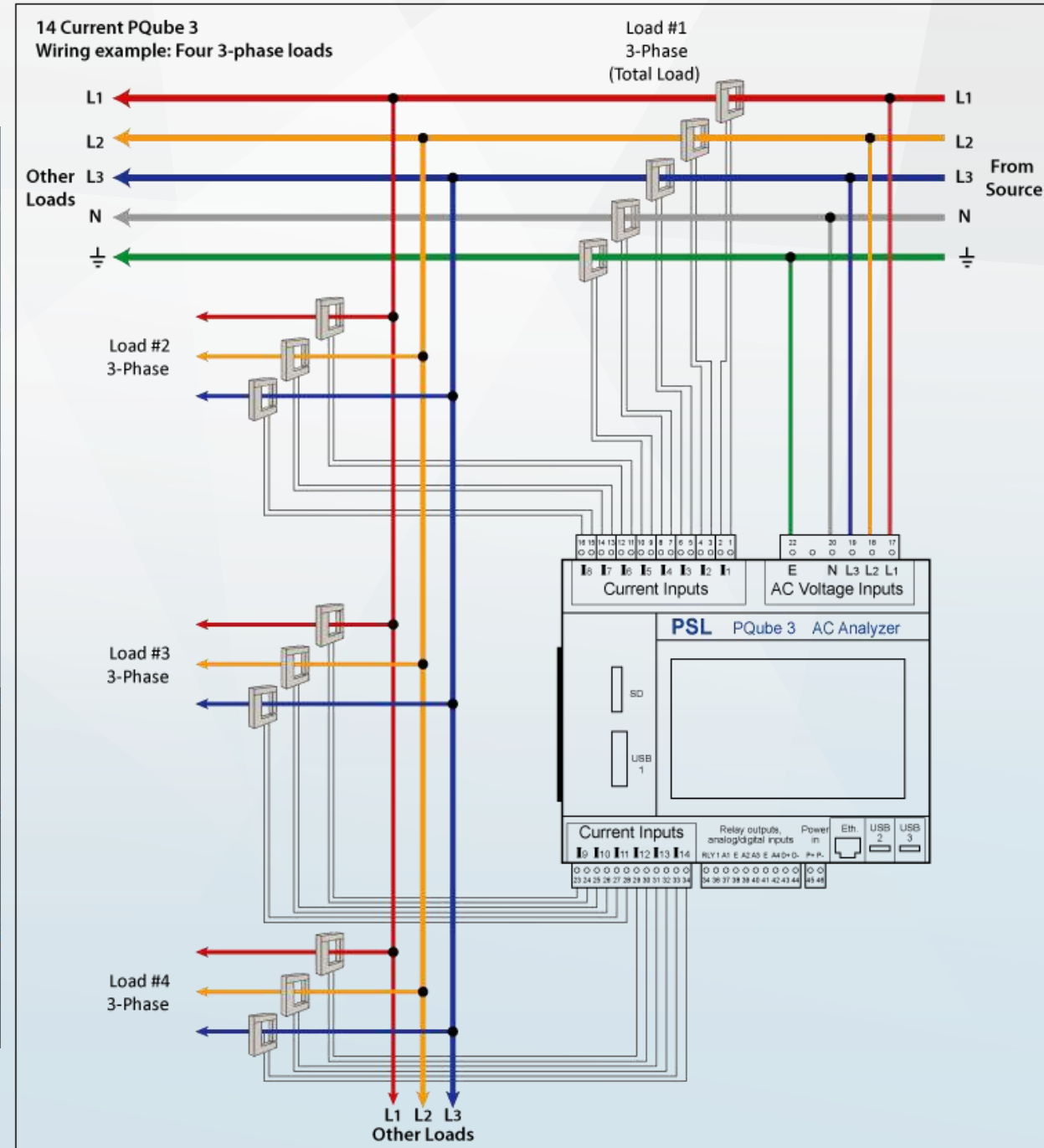
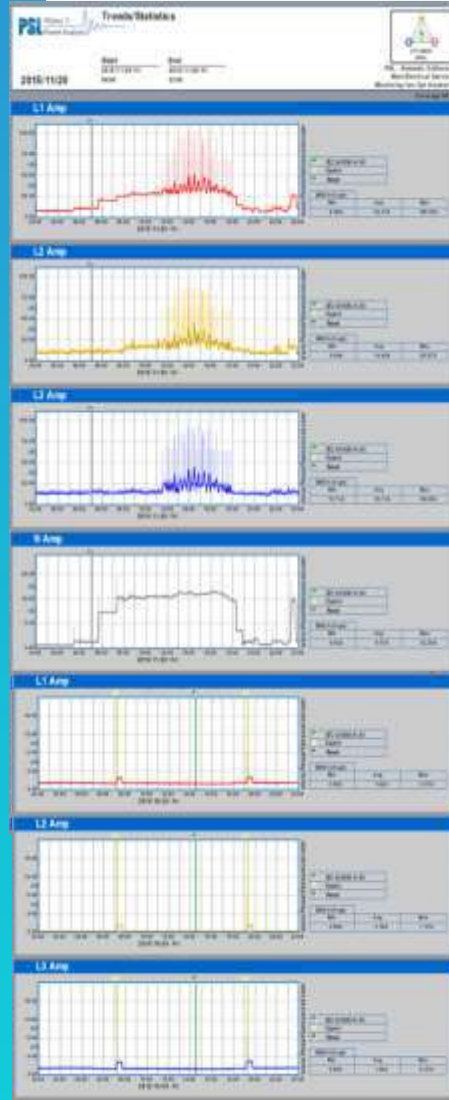


14 current channels
4 Three Phase Loads

14 current channels

Monitoring scenarios :

- 3 phase currents, Neutral current, Ground current (5 channels) PLUS 3 independent single phase loads
- Or 3 Phase currents , and 5 independent single phase channels



Four Analog Inputs

A multitude of combinations for measurements

Four Analog Inputs

+/-10V or +/-60V

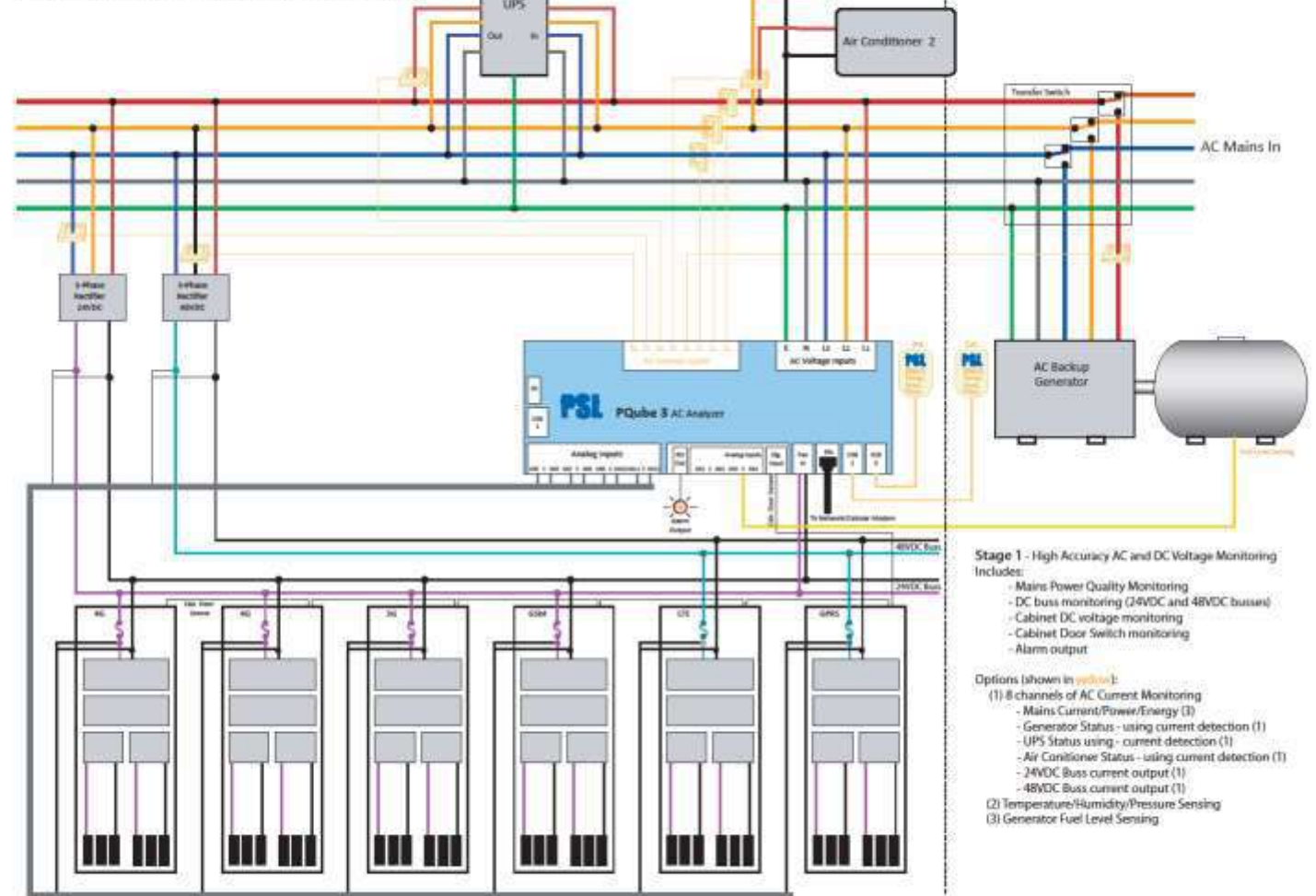
Perfect to monitor additional channels:

- Fuel levels (DC, telecom cellular towers..)
- Battery charge currents (DC,UPS, inverters ...)
- Battery voltage (DC, UPS, Inverters...)
- Mobile energy efficiency programs
- Verification of rectifiers noise
- 2kHz ~ 150 kHz rectifier emissions
- Wind speed velocity (Wind turbines)
- Wind turbines blade rotation speed
- Irradiance (sun light intensity (PV sites)
- Machine vibration levels
- And much more



Cellular Base Station Application

Stage 1: High Accuracy AC Power Quality and DC Monitoring



Dual voltage monitoring

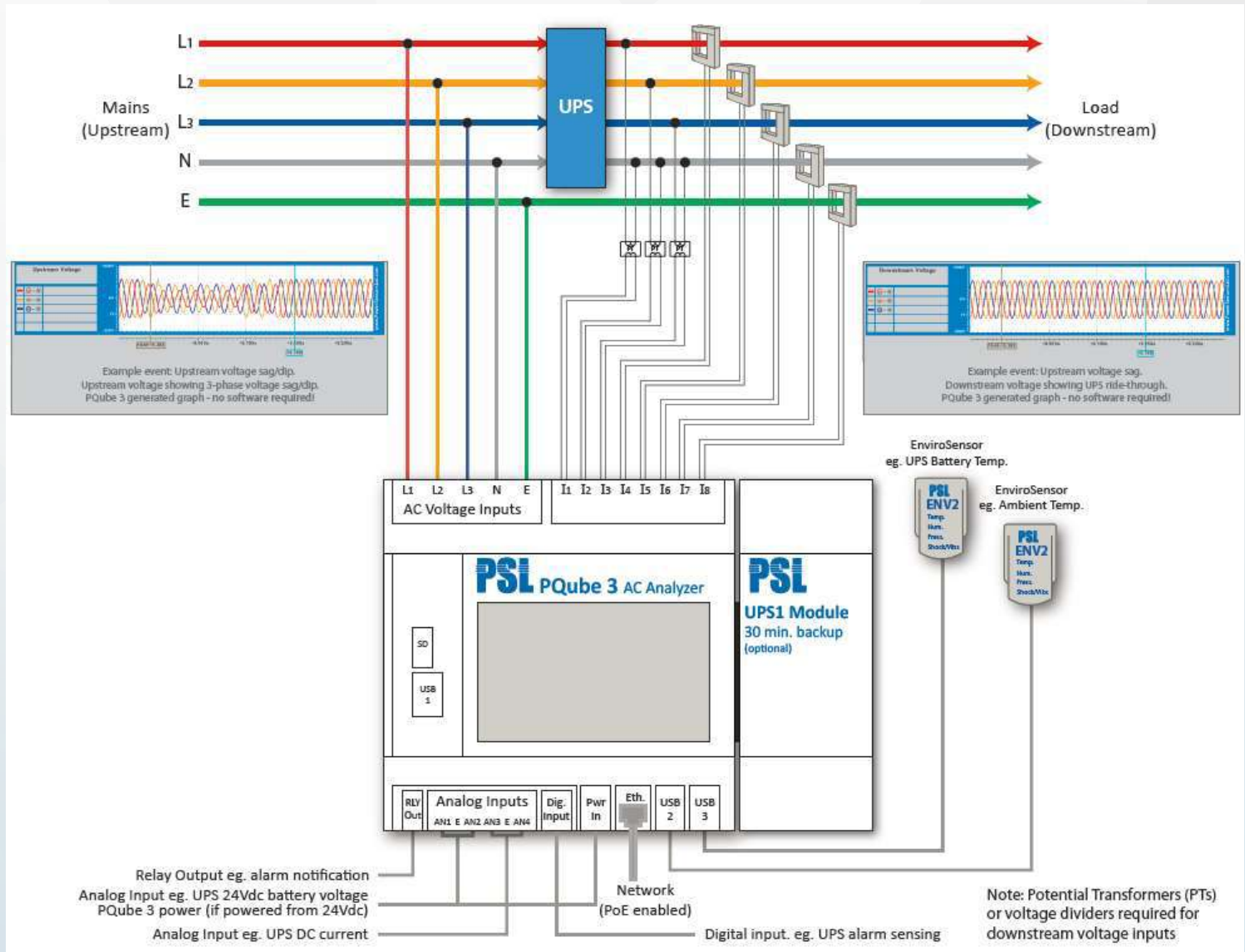
Great for UPS, DVR, ATS monitoring

Dual voltage monitoring

2 sets of 3 phase voltages:

Ideal for monitoring UPS, DVR, ATS...

- “upstream” set of voltages : flicker, harmonics sags/swells/interruption....
- “downstream” set of voltages: harmonics, sags/swells/interruption....
- 3 load currents



Three USB ports

Three USB ports

Front USB 2.0 port used for :

- Local configuration (read and write)
- Local firmware update
- Local measurement recordings extraction (read)

Two USB 1.0 port used for :

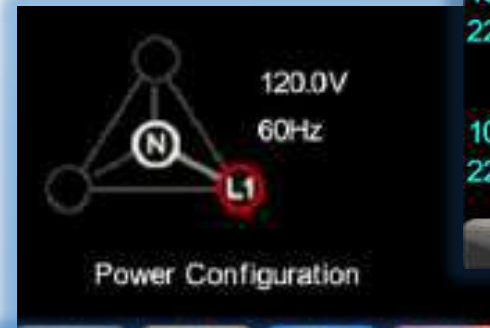
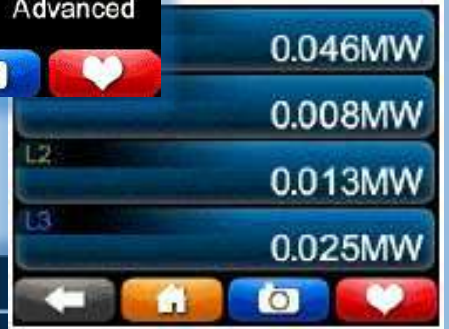
- Connecting ENV2 EnviroSensors
- Adds temperature /humidity /barometric pressure channels
- Adds mechanical shock/ seismic disturbance channels



Touch Screen

Touch Screen

- Can be operated with safety gloves
- Monitor voltage, currents, powers, frequency, harmonics, unbalances, EnviroSensors
- Review recent events directly on screen
- Review the wiring configuration and the waveform before you leave the site...
- Allows to extract measurement recordings on a USB thumb drive or on the extractible 8GB micro SDCard



| Recent Events | |
|----------------------|---|
| 10/09/14 22:01:49 | Voltage_Sag 0.241 sec, 0.00% |
| 10/09/14 22:01:49 | Sag_became_Major_Sa 0.241 sec, 0.00% |

The 'Recent Events' screen displays a list of recorded events with their dates, times, and descriptions. The screen includes the same navigation buttons as the main menu.

Digital Input

Digital Input

Triggers an event and recording upon occurrence of for example:

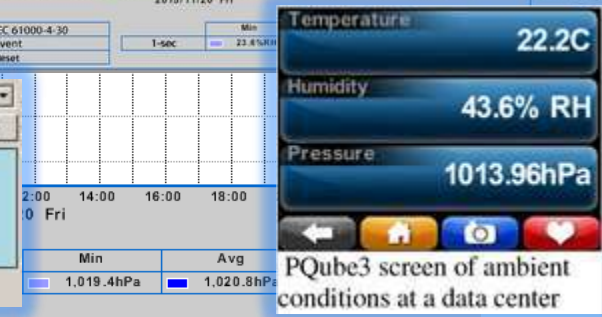
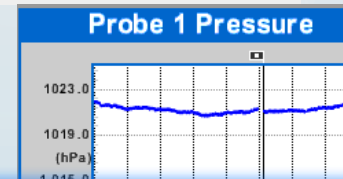
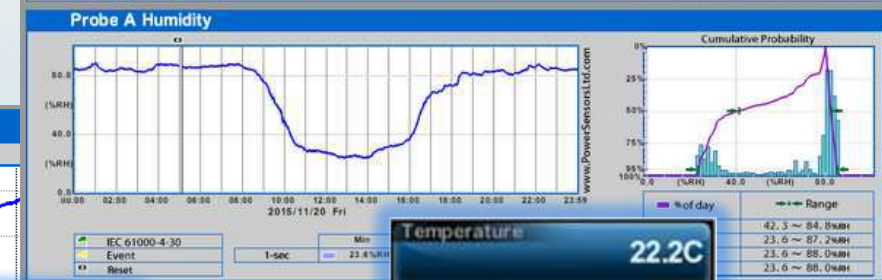
- Protection relay tripping
- ATS transfer switch command
- Overheat
- Process related actuator commands



Environmental Probes

ENV2 EnviroSensors

- Up to 2 ENV2 EnviroSensors to monitor for example, indoor and outdoor conditions
- Adds permanent or real time monitoring and detection (alarms) :
 - > temperature,
 - > humidity,
 - > barometric pressure
- Detect mechanical shocks/seismic disturbances with 3 axis accelerometer recordings



PQueue3 screen of ambient conditions at a data center



ENV2 EnviroSensors

- Detect mechanical shocks/seismic disturbances with 3 axis accelerometer recordings
- Mechanical shocks
- Tilt angle changes
- Seismic disturbances



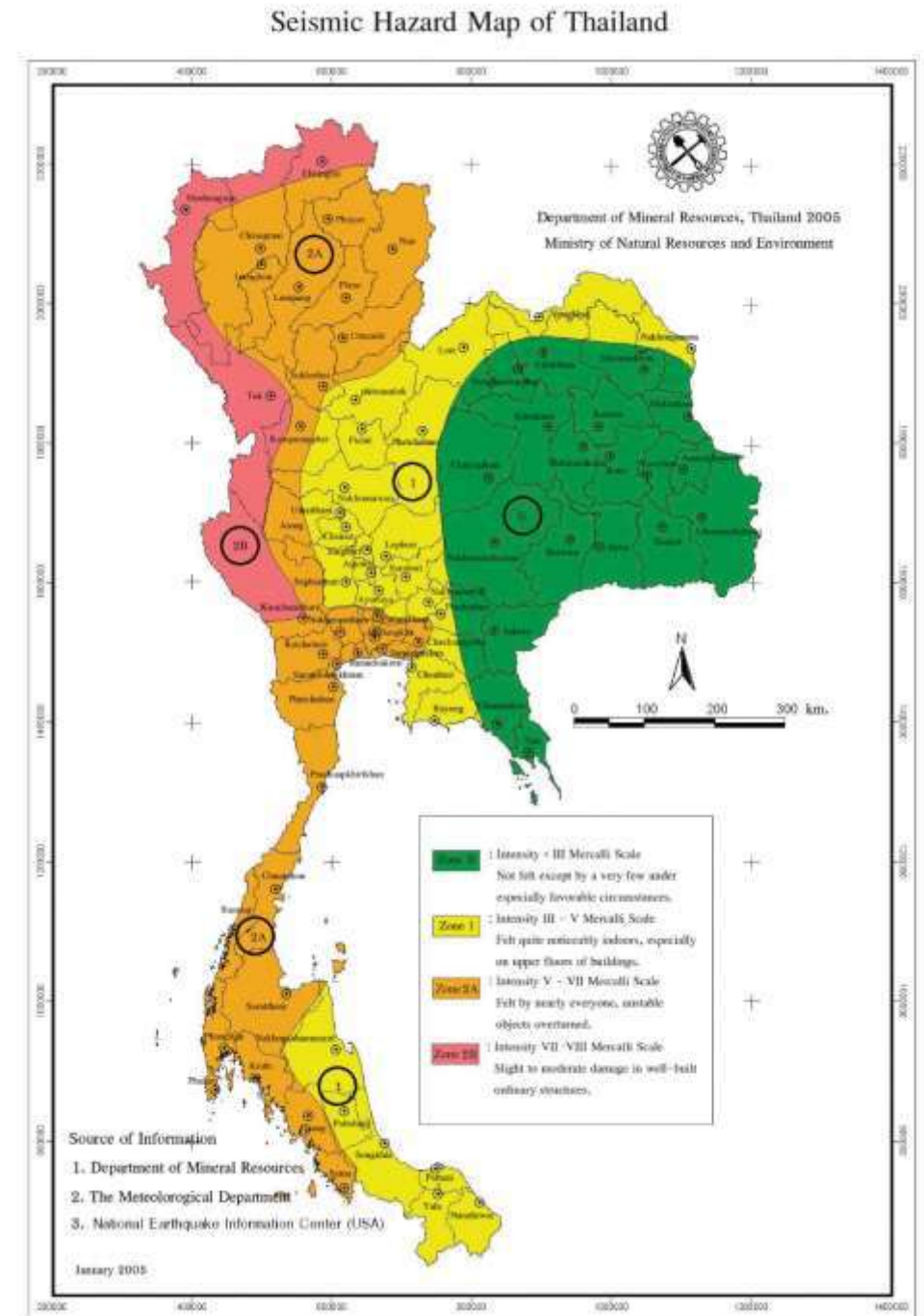
Important: What do fab customers owe you?

- > Power – clean or not? Reliable or not? Low source impedance or not?
- > Conditioned air – temperature, humidity, filtered
- > Process cooling water – flow? Contaminants? (Flint Michigan?)
- > Shelter from the elements – rain, snow, harsh sun, etc.
- > Good wafers and skilled operators

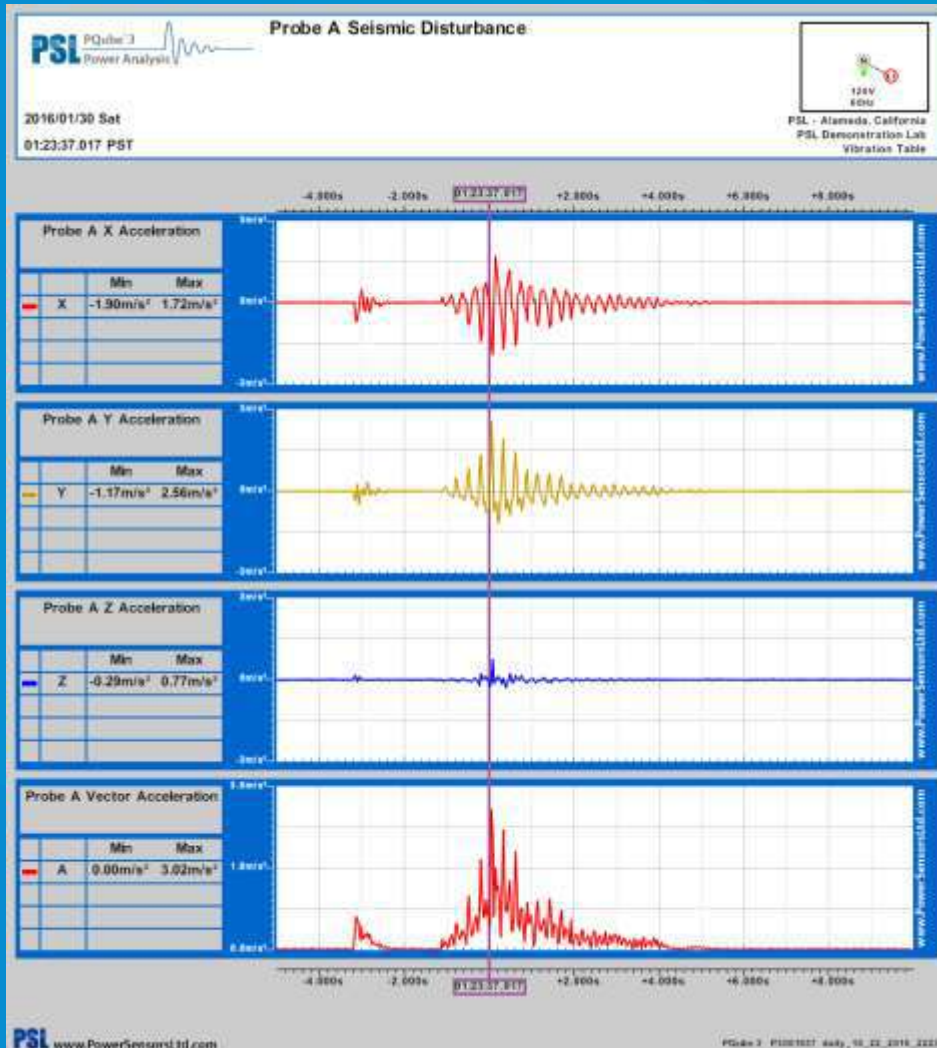
What else?

Important: Seismic activity and substations

Where do most earthquakes, big and small, happen?



New Seismic disturbance recording for substations and critical loads



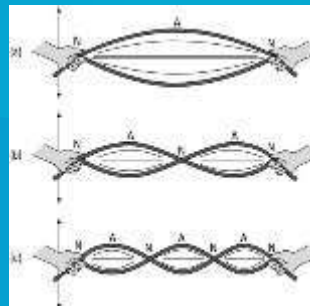
Every PQube 3 supports a pair of EnviroSensors – T/H/P/3-axis A

Seismic tremors are extremely local.

- > Constructive and destructive interference
- > Building structure – resonance, reflections, nodes and peaks

(450mm problem, especially)

Sensitive! PQube 3 EnviroSensor detects micro-tremors, too small for humans to feel, but can disrupt ultra-sensitive mechanical systems – mask align



Rogowski Coils Support

Flexible AC current sensors

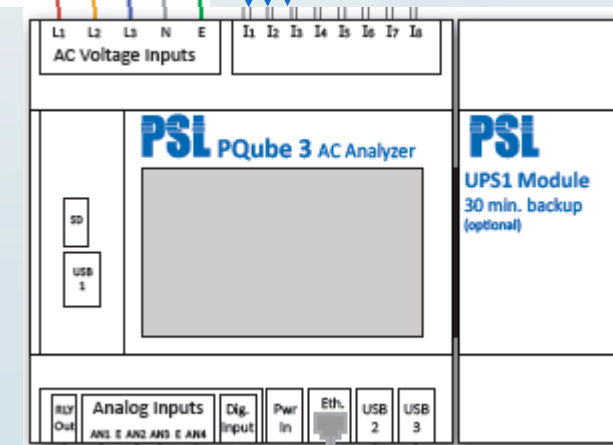
(Rogowski coils)

- Flexible, IP 65 weather resistant loop
- Plugs directly into your PQube 3 all 14 current inputs - no integrator required !
- Calibrated to match PQube 3 impedance
- Nominal 30 to 3000A range

No integrator required



Perfect for applications where limited space makes installation of traditional current transformers difficult or impossible.



ANSI 0.2 Class including Current Transformers!



PSL Ultra-Precise CT Series

With PSL advanced calibration technology, the measurement accuracy exceeds the requirements of Class 0.2, for both the meter and its CT's combined

Every CT comes with its own NIST-Traceable Calibration Certificate (see)

Best amplitude accuracy! $\pm 0.05\%$ typ
Best angular accuracy! $\pm 0.07^\circ$ typ

Best noise immunity! Fully shielded double-insulated cable

Time Synchronization

GPS, NTP, SNTP

Time synchronization

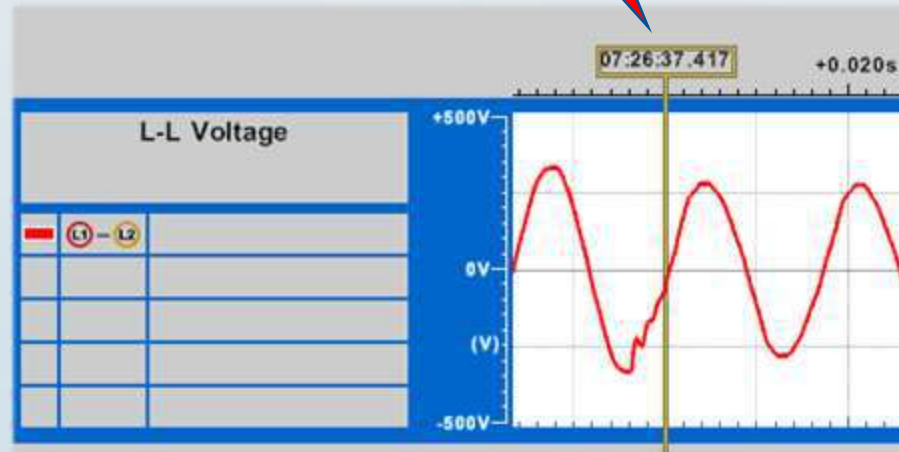
- GPS Time Synchronization

Perfectly synchronized time stamps to compare results from measurements done at different locations.

The most precise time-stamps available, better than Class A (by a factor of 10!) for power quality

Safest, most noise-free GPS receiver available – PSL-patent-pending full electrical isolation

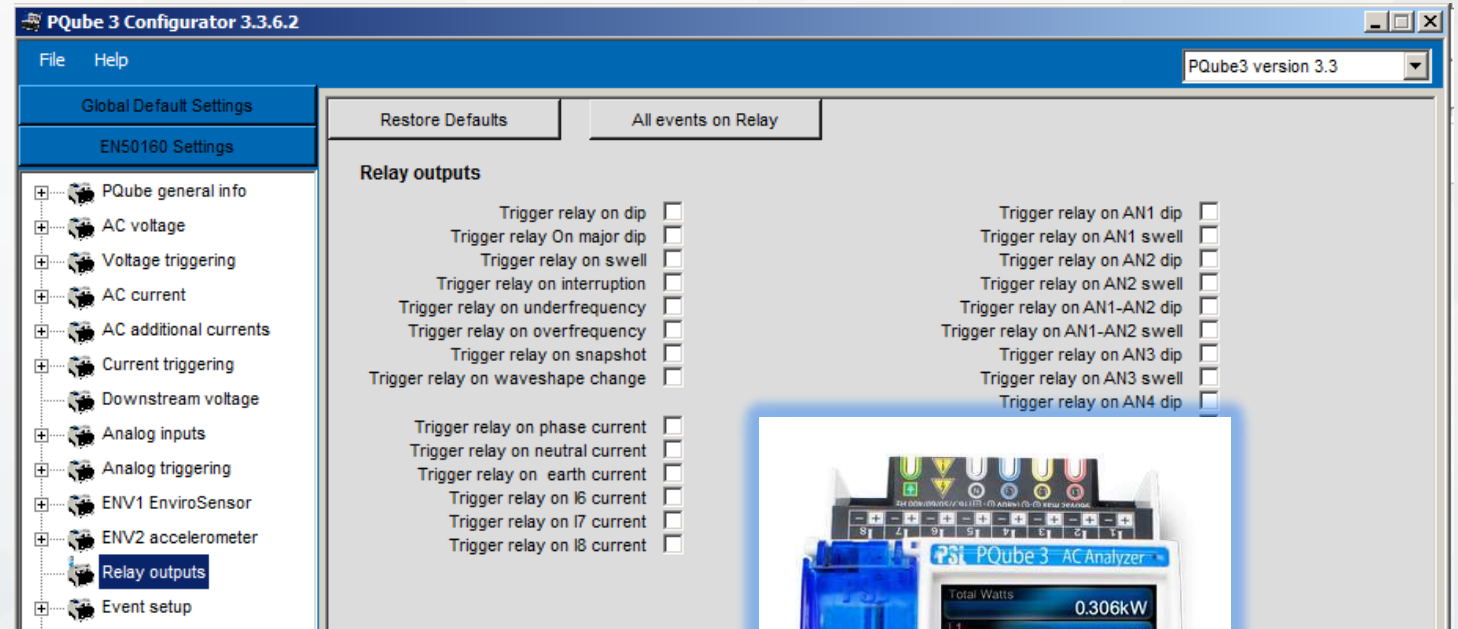
- Also synchronization via NTP and SNTP available



Latching Relay

Relay output

- Latching relay
- Can be programmed to trip on most of the PQube3 event detected:
- Sags, swells , interruptions
- Frequency
- Current faults
- Analog input (low and high thresholds)
-



SNMP
Version 1, 2c and 3 Ready

SNMP Interface

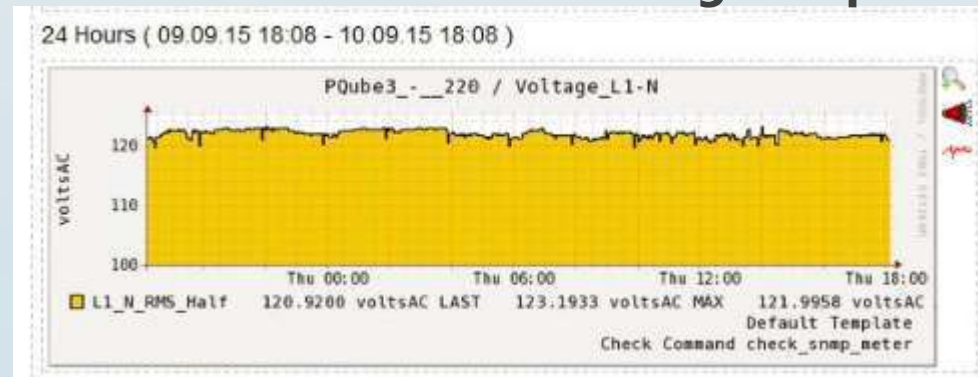
Simple Network Management Protocol

- Manage PQube 3's on the network just like routers, printers and servers ...
- Allows to monitor fleet status in real time
- Reports PQube3 measured parameters in long term charts.
- More than 300 polling registers available
- Compatible with V1, V2C and V3
- Receive immediate notification when event occur - TRAPS

| Time | TrapOID | Host | Category | Severity | Message |
|-------------------------|-----------------------|--------------|---------------|----------|---|
| Thu Mar 5 17:14:44 2015 | 1.3.6.1.4.1.36070.0.1 | 172.17.4.114 | Status Events | Warning | Event Waveshape_Change L1_N 2015-03-05T10:14:14.422Z 0.0000 0.0000 Blank 0.000000 TEST office@PSL |
| Thu Mar 5 17:14:33 2015 | 1.3.6.1.4.1.36070.0.1 | 172.17.4.114 | Status Events | Warning | Event Waveshape_Change L1_N 2015-03-05T10:14:14.422Z 0.0000 0.0000 Blank 0.000000 TEST office@PSL |
| Thu Mar 5 17:10:43 2015 | 1.3.6.1.4.1.36070.0.1 | 172.17.4.26 | Status Events | Warning | Event RVC L1_N 2015-03-05T17:07:30.574Z 0.0090 8.0000 Volts 4.000000 980 Atlantic Ave |
| Thu Mar 5 17:10:36 2015 | | | | | Event Interruption L1_N 2015-03-05T17:41:17.729Z 0.3170 0.0000 Percent 10.000000 980 Atlantic Ave |
| Thu Mar 5 17:05:48 2015 | | | | | Event Impulse L1_E 2015-03-05T17:41:17.561Z 0.0000 1289.0000 Volts 450.000000 980 Atlantic Ave |
| Thu Mar 5 17:04:56 2015 | | | | | Event Interruption L1_N 2015-03-05T17:41:17.729Z 0.0000 0.0000 Percent 10.000000 980 Atlantic Ave |
| Thu Mar 5 17:04:51 2015 | | | | | Event RVC L1_N 2015-03-05T17:41:13.224Z 0.0080 183.0000 Volts 4.000000 980 Atlantic Ave |
| Thu Mar 5 17:04:50 2015 | | | | | Event RVC L1_N 2015-03-05T17:41:13.224Z 0.0000 0.0000 Volts 4.000000 980 Atlantic Ave |
| Thu Mar 5 17:04:47 2015 | | | | | Event RVC L1_N 2015-03-05T17:21:25.839Z 0.0080 175.0000 Volts 4.000000 980 Atlantic Ave |
| Thu Mar 5 17:04:41 2015 | | | | | Event RVC L1_N 2015-03-05T17:21:25.839Z 0.0080 175.0000 Volts 4.000000 980 Atlantic Ave |
| Thu Mar 5 17:04:38 2015 | | | | | Event Waveshape_Change L1_N 2015-03-05T10:14:14.422Z 0.0000 0.0000 Blank 0.000000 TEST office@PSL |
| Thu Mar 5 17:04:35 2015 | | | | | Event Waveshape_Change L1_N 2015-03-05T10:14:14.422Z 0.0000 0.0000 Blank 0.000000 TEST office@PSL |
| Thu Mar 5 17:04:30 2015 | | | | | Event RVC L1_N 2015-03-05T17:07:30.574Z 0.0090 8.0000 Volts 4.000000 980 Atlantic Ave |

SNMP traps

SNMP register polling



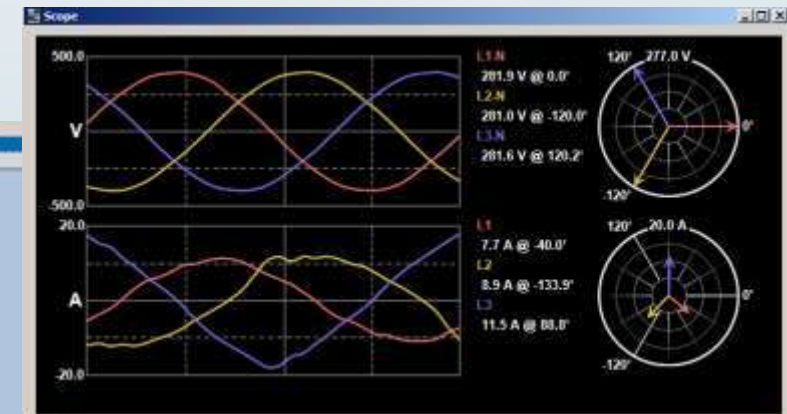
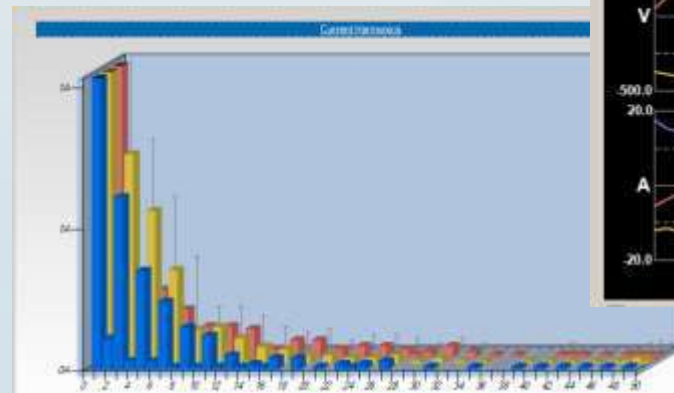
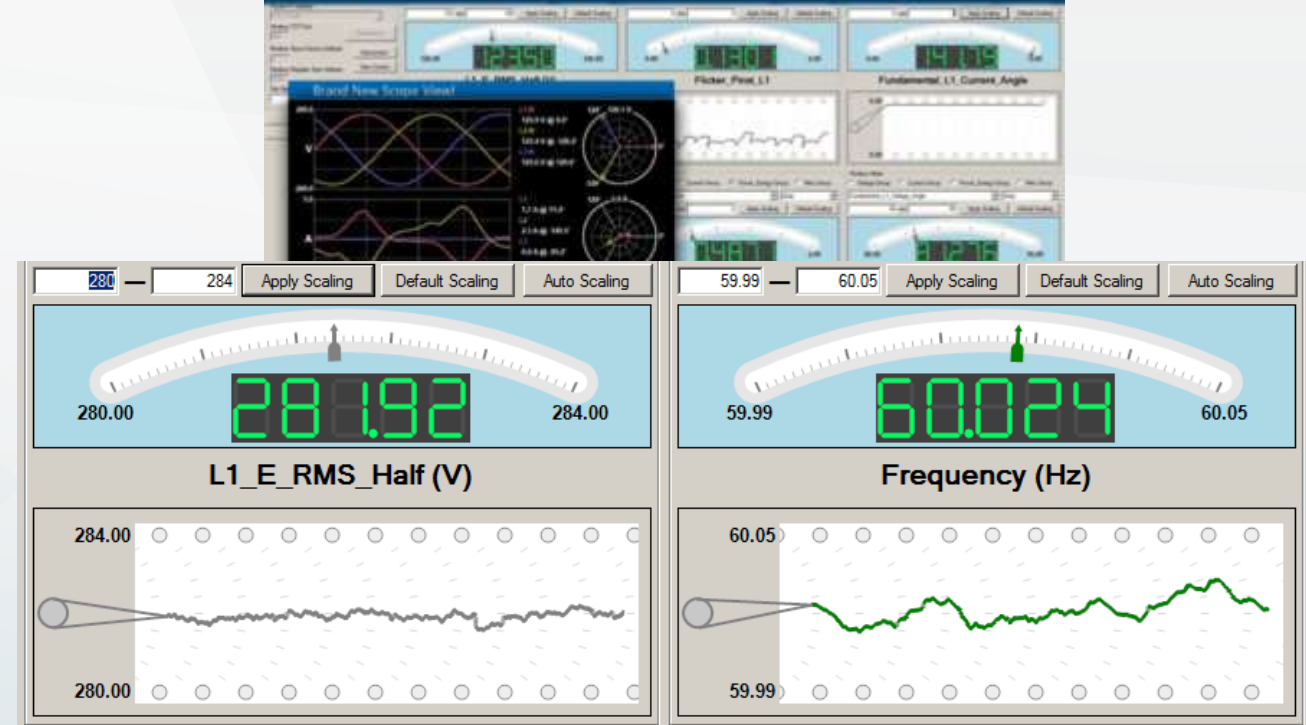
MODBUS TCP/IP Ready

Modbus Interface

- More than 3000 registers available
- Simultaneous client connections
- Scan rate up to 3 times a second
- Free Modbus client !
- Waveform voltage and currents
- Harmonic spectrum
- 2kHz -150kHz spectrum
- In REAL TIME !

PQube 3 Modbus Client

Our New Modbus Client is 5x Times Faster and Records Data Straight to CSV!



KYZ Output

KYZ Output

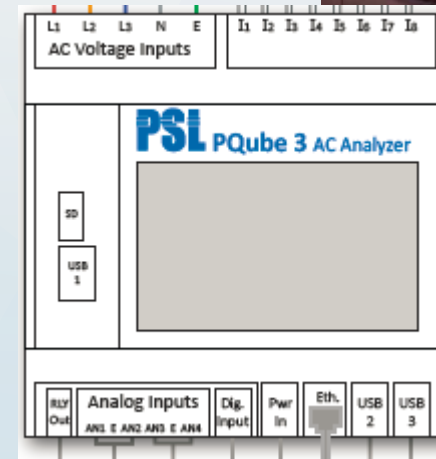
- PQube3 uses its output relay RLY+ and RLY- for the output toggling function
- Pulse per energy units configured by user (e.g. 1kWh)



480 – 750 - 1200 Volts DC
up to 1500 Amps DC

High voltage DC measurements

- Data centers - 400VDC
- Metro & Tramway electrification 600 -750 VDC
- PQube 3 can measure :
up to 1200VDC ,
ATT1 attenuator modules
- up to 1500Amps DC,
(Hall effect sensors) – ATT2 modules



PQube 3
is easy to install, anywhere....

PQube 3 Installation options

- On DIN –rail
- On poles
- On walls
- In 19" rack
- Portable



Pre-wired rugged pole-mount



Pre-wired rugged wall-mount



Snap onto DIN-rail



Use your own DIN rail enclosure

PQube 3 Installation

Portable

- Pluggable connections - easy field wiring.
- Voltage measurement range 100~480Vac
- 8 current channels
- Relay output, analog and digital inputs
- PQube 3 powered from measured voltage (360~480Vac), or 24Vdc input plug.
- 30-minute internal battery backup for PQube 3
- Fused voltage cables with alligator clips included
- Temperature rating: -20 to +50°C

